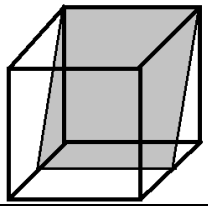
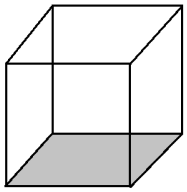
Name: **Enrolment No:**	

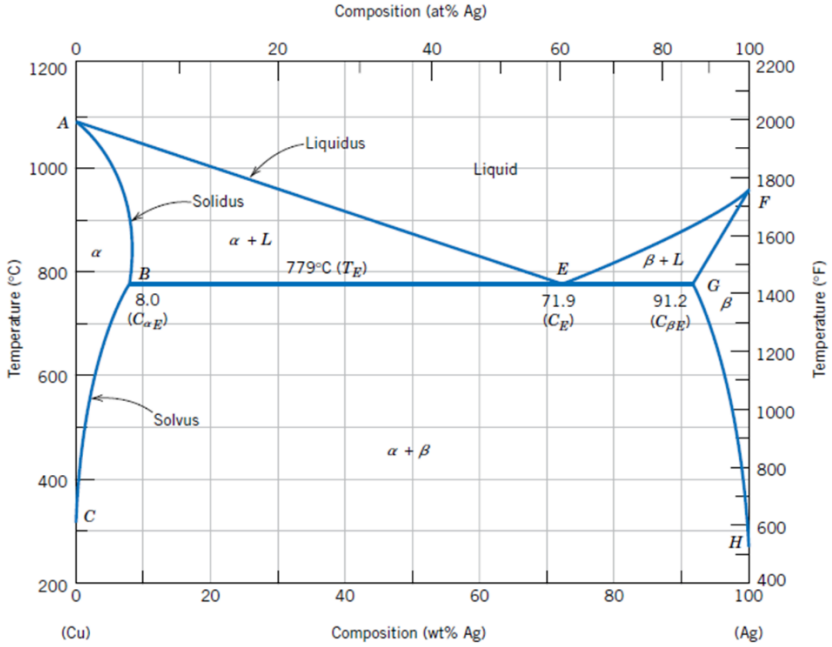
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Supplementary Examination, May 2023

Programme Name : B. Tech-Mechatronics Engineering Semester : III
Course Name : Materials Science Time : 03 hrs.
Course Code : MEMA2005 Max. Marks : 100
Nos. of page(s) : 2

Instructions: Attempt all questions. One question from section B and C have an internal Choice. Assume any missing data if required.

SECTION A

S. No.		Marks	CO
Q1	Identify the Miller Indices of the following planes.  	2+2	**CO1**
Q2	Differentiate ductility and malleability. Given an example of ductile and malleable materials.	4	**CO1**
Q3	Define stress concentration and its negative effect on fatigue life.	4	**CO2**
Q4	Differentiate in between eutectic, eutectoid and peritectic invariant reactions.	4	**CO3**
Q5	Classify the different cast irons.	4	**CO4**
	SECTION B		
Q6	(a) Sate Hume Rothery,s rules and discuss in detail. (b) Define homogeneous and heterogeneous nucleation. (c) Write the coordination number for BCC, FCC, and HCP unit cell.	4 3 3	**CO1**
Q7	(a) Compare destructive and non-destructive test. (b) Explain visual testing and state its applications and limitations.	4 6	**CO2**
Q8	(a) Derive the expression which relates interplanar spacing, Miller indices and dimension of the cubic unit cell. (b) Illustrate the process of measuring toughness values for structural materials.	5 5	**CO3**
Q9	A (i) Define fatigue failure. Neatly sketch the various fatigue loading cycles. (ii) Define Low cycle fatigue and explain the method to estimate the fatigue damage in metals. Or B (i) List out the factors that affect fatigue life of a structural component. (ii) Explain with neat sketches the two modes of fracture failure of metal.	 5 5 5 5	**CO2**

SECTION-C			
Q10	(i) Sketch neat and completely labelled TTT curve. (ii) Discuss the effect of cooling rate on grain size using example of various microstructures formed during heat treatments. (iii) Classify various methods of Hardening steels.	6 8 6	**CO3**
	A. Analyze the Cu-Ag Phase diagram and answer the following questions: (i) Write the solubility limit and temperature of eutectic composition. (ii) Write the invariant reaction with phase composition. (iii) Sketch and explain the microstructure evolution of 5% Cu - 95% Ag alloy.  **B.** Develop the microstructure evaluation of Cu - Ag alloy at eutectic composition with its phase composition and relative amount of phase present. Or (a) A binary alloy having 28 wt % Cu & balance Ag solidifies at 779 ºC. The solid consists of two pahses α & β. Phase α has 9% Cu whereas phase β has 8% Ag at 779ºC. At room temperature these are pure Ag & Cu respectively. Sketch the phase diagram. Label all fields & lines. Melting points of Cu & Ag are 1083 ºC & 960 ºC respectively. Estimate the amount of α & β in the above alloy at 779 ºC & at room temperature. (b) Discuss aluminum alloys and copper alloy in details and their engineering application.	2 2 10 6 10 10	**CO4**